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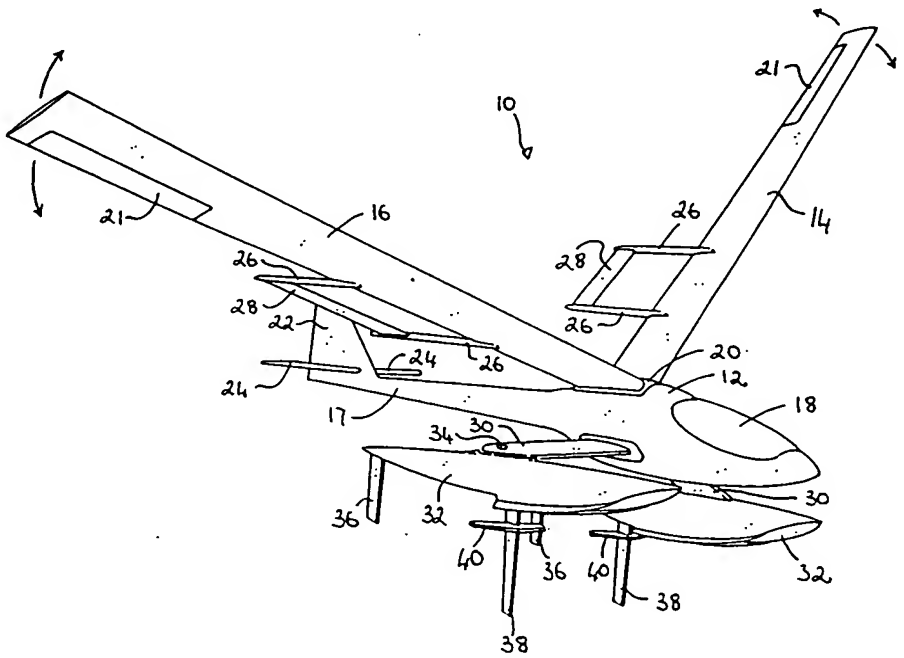
(54) Title: WIND DRIVEN CRAFT



(57) Abstract

A wind driven craft (10, 10a) comprising a body (12) and a pair of wings (14, 16) extending therefrom. The wings are pivotally connected to the body (12) of the craft (10). The wings (14, 16) provide lift and thrust to the craft (10) such that it is able to move under influence of the wind.

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TITLE

WIND DRIVEN CRAFT

DESCRIPTION

The present invention relates to a wind driven craft.

FIELD OF THE INVENTION

The present invention provides a wind driven craft which may travel on water.

With modifications, the craft may be arranged to travel on substantially solid surfaces.

Further, the present invention provides a craft which can be arranged for flight, either as a glider or under motor power.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided a wind driven craft comprising a body and wing means pivotally attached to said body wherein said wing means provide lift and thrust to said craft such that said craft may move under influence of the wind.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a first embodiment of the craft of the present invention;

Figure 2 is a front elevational view of the craft shown in Figure 1 showing an analysis of forces acting on the craft 10 for a particular orientation of the wings with the wind direction being into the page;

Figures 3a and 3b show the positions of the wings and hulls for a starboard tack;

Figures 4a and 4b show the positions of the wings and hulls for travel into the wind;

Figures 5a and 5b show the positions of the wings and hulls for a port tack; and

Figure 6 shows a perspective view of a second embodiment of the craft of the present invention.

DESCRIPTION OF THE INVENTION

In Figure 1 there is shown a wind driven craft 10 for use on water.

The craft 10 comprises a body 12 and a pair of wings 14 and 16 attached thereto. The body 12 is substantially of fuselage form and comprises a tail boom 17 and a cockpit or operator/passenger compartment 18.

The wings 14 and 16 are connected to a rigid joint 20. The rigid joint 20 is pivotally connected to the body 12 about an axis substantially parallel to the longitudinal axis of the body 12. The pivotal directions of the craft 10 are shown by arrows in Figure 1.

The wings 14 and 16 may be provided with control surfaces or ailerons 21.

The wings 14 and 16 are driven into the required position by mechanical means or may be flown into the required position by the ailerons 21.

The wings 14 and 16 may be retained in their required relative position by suitable means (not shown), e.g. struts, latches and/or cables.

An air rudder 22 and elevators 24 are provided at the rear of the body 12. The air rudder 22 consists of a vertical steering fin assembly whilst the elevators 24 consist of horizontal airfoil plane structures.

Alternative tail configurations are also possible, e.g. a

vee tail.

The air rudder 22 and elevators 24 control the angle of attack and hence the lift of thrust the wings 14 and 16. Alternatively, the angle of attack and hence the lift/ thrust of the wings 14 and 16 may be controlled by control surfaces 28 attached to each of the wings 14 and 16. Two control surfaces 28 are rotatably struts 26 which are attached to each wing 14 and 16. In this case, each of the wings 14 and 16 is also able to pivot about an axis substantially parallel to its longitudinal axis.

The craft 10 further comprises an outrigger 30 extending from each side of the body 12. A hull 32 is pivotally attached at the distal end of each of the outriggers 30 by a connection 34 which allows the hulls 32 to pivot about a substantially vertical axis.

The outriggers 30 are attached to the body 12 by suspension elements (not shown). These suspension elements allow vertical motion of the hulls 32. The pivotal connections 34 allow steering motion of the hulls 32 relative to the remainder of the craft 10.

The outriggers 30 support the body 12 and allow for vertical compliance for negotiating uneven water surfaces such as waves.

The hulls 32 are provided with rudders 36 at their rears which control their direction of steer.

The hulls 32 may be stepped, planing type hulls such that at increased speeds the wetted area is reduced and the planing point is near the centre of mass of the craft 10. As an alternative, a central single hull (not shown)

integral with the body 12, may be used. Such a hull may be used with or without smaller outboard floats.

One or more skegs 38 are provided on each of the hulls 32. The skegs 38 may be air foil shaped or super cavatating shaped. Super cavatating foils are used for high speeds. As an alternative, a central skeg (not shown) may be mounted under the body 12.

Planing or lift foils 40 are mounted on the skegs 38 and arranged substantially at right angles thereto. The planing/lift foils 40 tend to lift the hulls 32 clear of the water and to plane on the surface of the water. This allows the planing/lift foils 40 to penetrate breaking waves reducing slamming forces and energy absorption by waves.

As an alternative, a central single or multiple planing/lift foil (not shown) with active suspension may be used. Such a central planing/lift foil may or may not be integral with a central skeg (not shown).

Operator controls (not shown) are provided in the compartment 18 such that an operator seated therein may control the direction of travel of the craft 10 and other control elements, hereinbefore described, for regulating the vertical orientation, wing position and speed of the craft 10.

The pivoting of the wings 14 and 16 is controlled by a latch and/or brake mechanism (not shown) which releases and subsequently holds the wings 14 and 16 in the required position.

The control surfaces 28 are pivotable relative to the

struts 26 and operator controls are provided in the compartment 18 for this.The rudders 36 are steered by means of hand or foot operated controls. This controls the direction of travel of the craft 10. The rudders 36 are connected to operator controls in the compartment 18 by a linkage system. The linkage system may be a reflex type system such that once an angle setting is made the rudders 36 tend to steer the hulls 32 into that angle relative to the body 12. If the hulls 32 pivot away from that angle the linkage system causes the rudders 36 to pivot to return the hulls 32 back to the desired angle setting.

Alternative rudder systems may be employed whereby the rudders are steered to a desired angle setting and/or the rudder is attached to a skeg on a boom assembly.

The wings 14 and 16 are positioned at a fixed relative angle to one another. This angle is determined to provide optimum performance of the craft 10. However, the wings 14 and 16 may pivot relative to one another and then be locked into their relative position once the required angle of separation has been set.

Independent pivoting of the wings 14 and 16 allow them to be both positioned in a substantially horizontal position such that the craft 10 may operate as a glider. The wings 14 and 16 may be constructed of any suitable material and may be non-rigid (e.g. cloth), rigid (e.g. fibreglass, wood, etc), internally braced (e.g. spars, beams) or externally braced (e.g. guy wives, struts, etc).

In Figure 2, there is shown a schematic front view of the craft 10 showing a force analysis for the craft 10.

In the configuration of the wings 14 and 16 shown in Figure 2, the wing 16 is substantially horizontal and produces mostly lift for the craft 10, shown by the arrow 42, whilst the wing 14 is substantially upright and produces mostly thrust, shown by the arrow 44.

An overturning force, shown by arrow 46, is balanced by a righting force, shown by arrow 48.

The skegs 38 project below the surface of the water and provide a horizontal reaction or water thrust as a reaction to the horizontal thrust 44. This is shown by the arrows 49. The angle between the skegs 38 and the thrust wing (being wing 14 in Figure 2) is such that it produces a vector sum resulting in forward thrust for the craft 10.

The planing/lift foils 40 provide lift to the hulls 32, shown by arrows 51.

The rudder 22 and elevators 24 at the tail of the craft 10 provide directional control for the lifting and thrusting wings 16 and 14.

The wings 14 and 16 may be pivoted about the axis that lies parallel to the longitudinal axis of the body 12 to effect tacking/jibing. This may be done by way of mechanical means or ailerons 21 as hereinbefore described by the operator operating the appropriate controls.

Figures 3a and 3b show the positions to which the wings 14 and 16 and the hulls 32 are pivoted to effect a starboard tack with the direction of the wind shown by the arrow 50. The wings 14 and 16 are pivoted such that the wing 16 produces mostly thrust, whilst the wing 14 produces mostly lift. The hulls 32 are pivoted in the required direction

as shown.

Figures 5a and 5b show the positions to which the wings 14 and 16 and the hulls 32 are pivoted to effect a port tack, the wind direction being shown by the arrow 48.

These positions are the reverse of those for the starboard tack shown in Figures 3a and 3b.

Figures 4a and 4b show the positions of the wings 14 and 16 and the hulls 32 when the craft 10 is being driven into the wind. The wind direction is again shown by arrow 50. The symmetrical position of the wings 14 and 16 means that they produce a substantially equal amount of lift and thrust so that the craft 10 moves in the forward direction. The hulls 32 are positioned in the forward pointing direction.

Figure 6 shows another embodiment of a craft 10a. The craft 10a is similar to the craft 10 except that it is provided with a motor and propeller assembly 52. The wings 14 and 16 of the craft 10a may be locked in a substantially horizontal position such that the craft 10a may operate as an aircraft.

The craft of the present invention may also be provided as a wind driven craft for travel on substantially solid surfaces, e.g. land, ice, snow etc. In such an embodiment the hulls 32 of the craft 10 of the first embodiment are replaced by wheels skates, runners, etc. or appropriate traction means for the particular terrain over which the craft is to be driven.

In the craft for travel on substantially solid surfaces the wings 14 and 16 providing lift and thrust are installed on opposite sides of the craft 10 to that in the water going

craft 10.

This results in the forces being in balance but with the main "lift" force being downward rather than upward.

CLAIMS

1. A wind driven craft characterised in that it comprises a body and wing means pivotally attached thereto wherein said wing means provides lift and thrust to said craft such that said craft may move under influence of the wind.

2. A wind driven craft according to claim 1, characterised in that said wing means comprises a pair of wings extending from said body and pivotable in unison about an axis substantially parallel to a longitudinal axis of said body.

3. A wind driven craft according to claim 2, characterised in that said wings are pivotable individually about said axis and may be locked in a selected relative position such that they are pivotable in unison.

4. A wind driven craft according to claim 2 or 3, characterised in that said wings are provided with ailerous to cause said wings to pivot about said axis.

5. A wind driven craft according to claim 2 or 3, characterised in that mechanical means is provided to cause said wings to pivot about said axis.

6. A wind driven craft according to claim 2 or 3, characterised in that said body comprises elevator means and air rudder means at the rear thereof to control the angle of attack and lift/thrust of said wings.

7. A wind driven craft according to claim 2 or 3, characterised in that control surface means are provided on each said wing to control the angle of attack and lift/thrust of said wings and wherein each said wing is able to pivot about a second axis substantially parallel to each said wing.

8. A wind driven craft according to claim 7, characterised in that said control surface means comprise a pair of control surfaces located rearwardly of each wing and joined to each respective wing by a pair of struts such that said control surfaces are pivotable relative to their respective struts.

9. A wind driven craft according to claim 2 or 3, characterised in that said craft further comprises hull means connected to said body to support said craft on water.

10. A wind driven craft according to claim 9, characterised in that said hull means comprises a pair of hulls with one of said hulls being positioned on each side of said body wherein each said hull is connected to said body by a respective outrigger arm to which said hulls are pivotally attached.

11. A wind driven craft according to claim 9, characterised in that rudder means is movably connected to the underside of said hull means.

12. A wind driven craft according to claim 9, characterised in that skeg means is connected to the underside of said hull means.

13. A wind driven craft according to claim 13, in that said skeg means is provided with planing/lift foil means arranged substantially at right angles thereto.

14. A wind driven craft according to claim 2 or 3, characterised in that said craft further comprises wheel, skate or runner means connected to said body to support said craft on substantially solid surfaces.

15. A wind driven craft according to claim 3, characterised in that said wings are lockable at a position in which they extend in a substantially horizontal direction on opposite sides of said body such that said craft is operable as a glider aircraft.

16. A wind driven craft according to claim 3, characterised in that said wings are lockable at a position in which they extend in a substantially horizontal direction on opposite sides of said body and said craft is provided with propeller and motor assembly means such that said craft is operable as a powered aircraft.

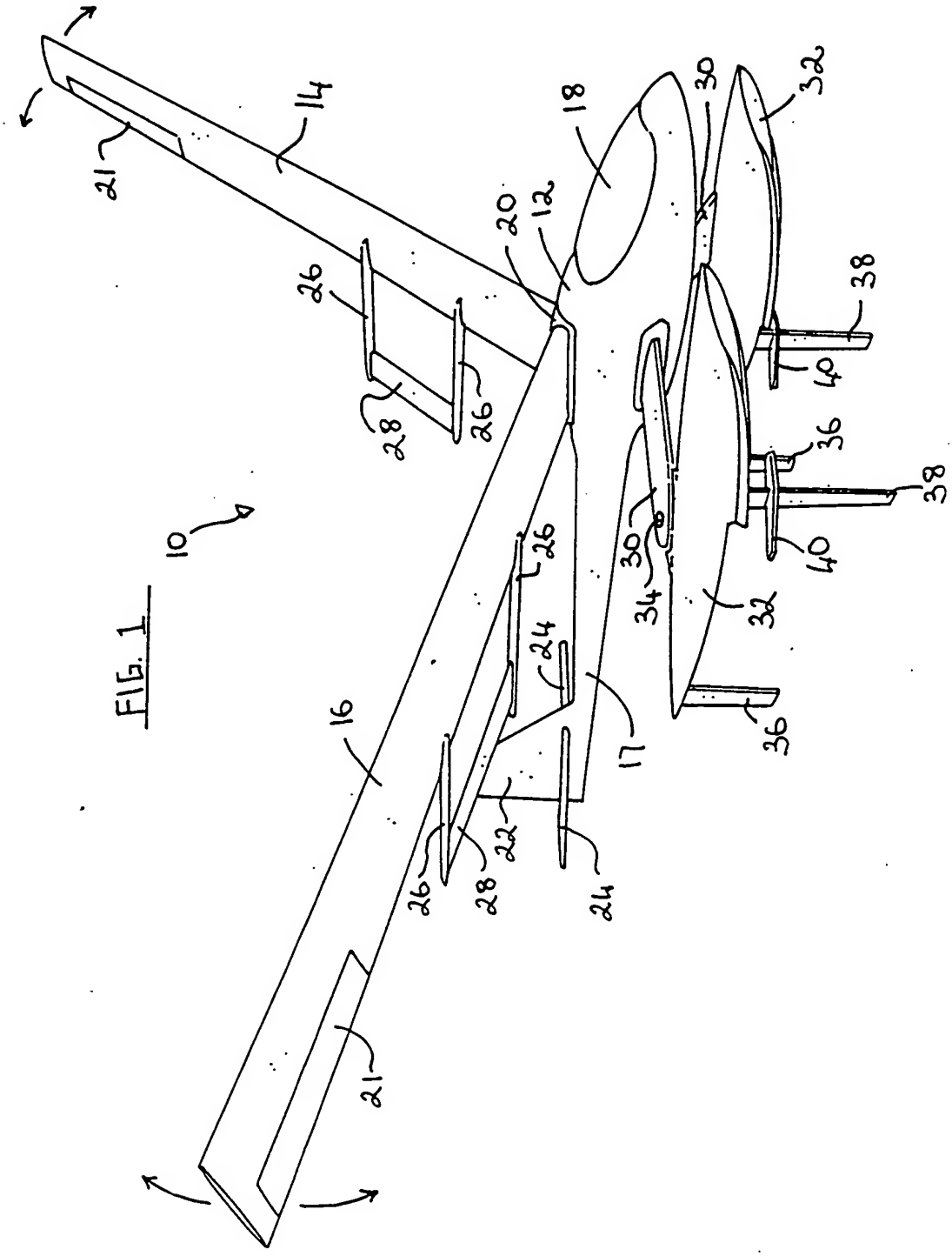


FIG. 1

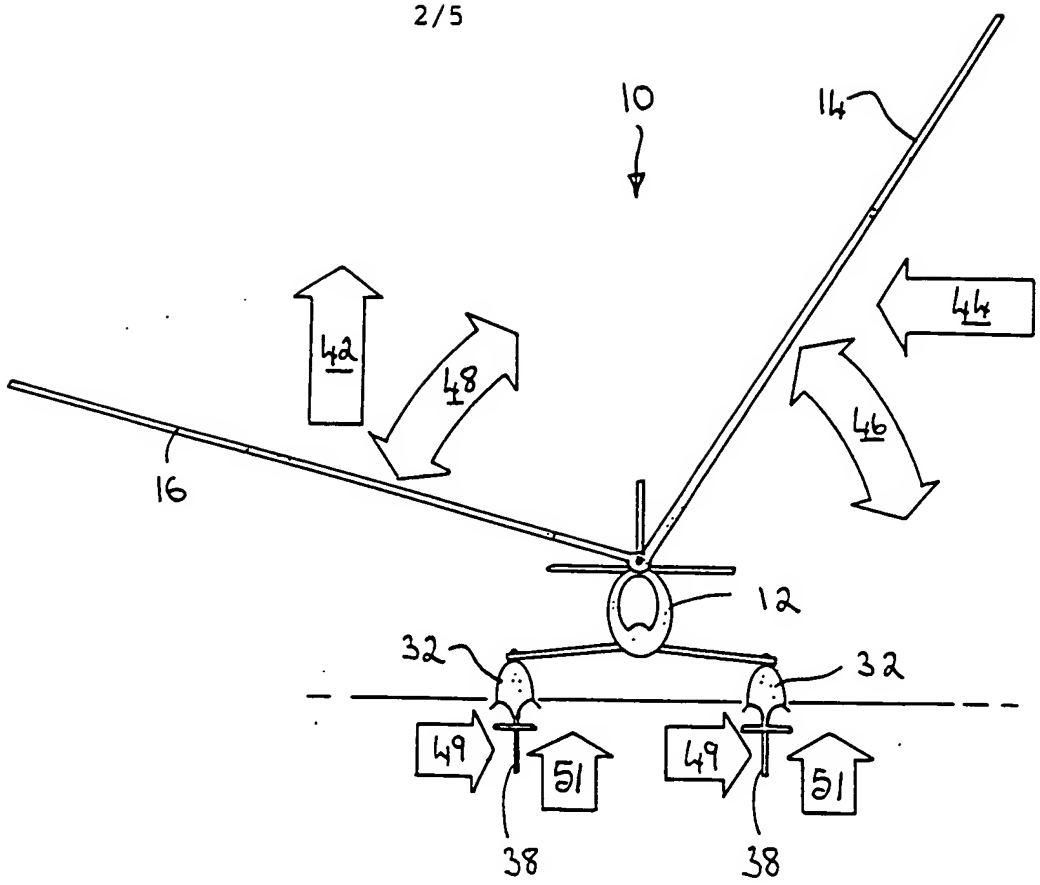


FIG. 2

FIG. 3(a)

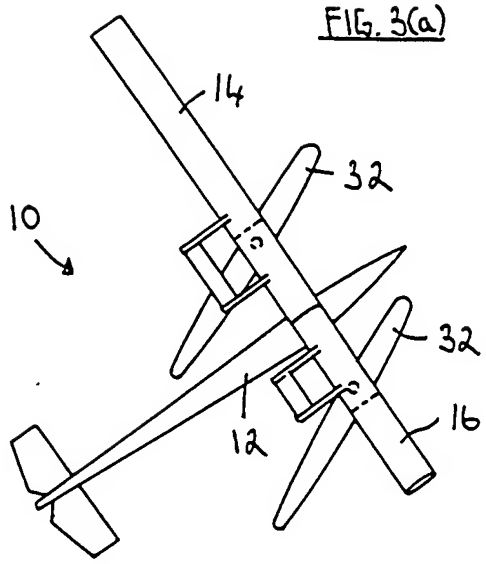


FIG. 3(b)

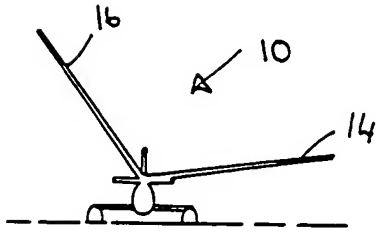


FIG. 4(a)

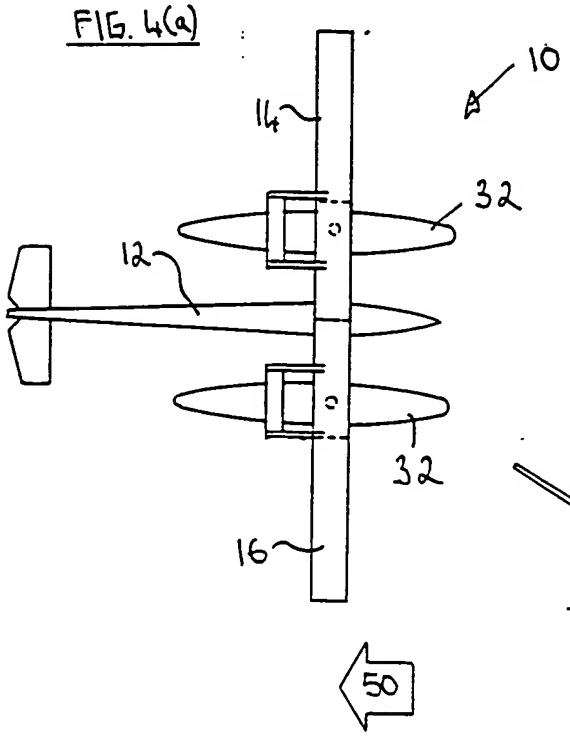


FIG. 4(b)

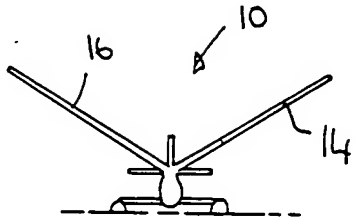


FIG. 5(a)

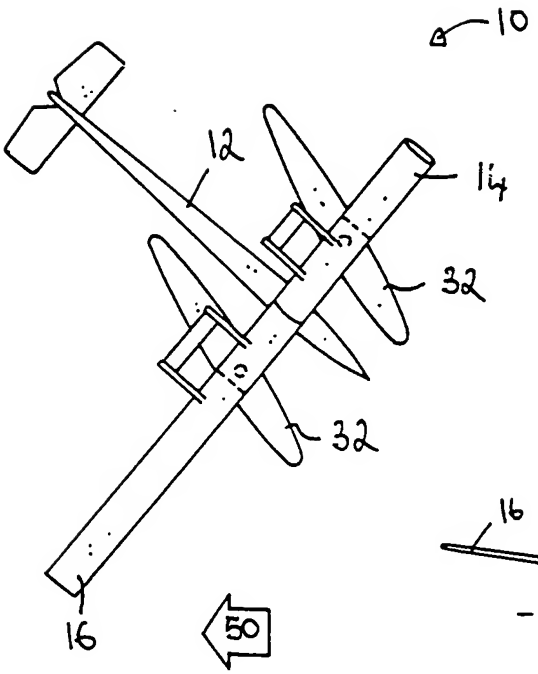
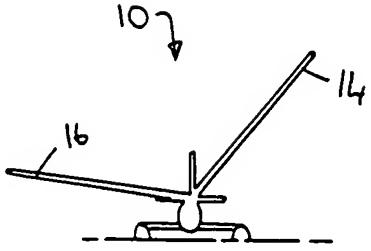


FIG. 5(b)



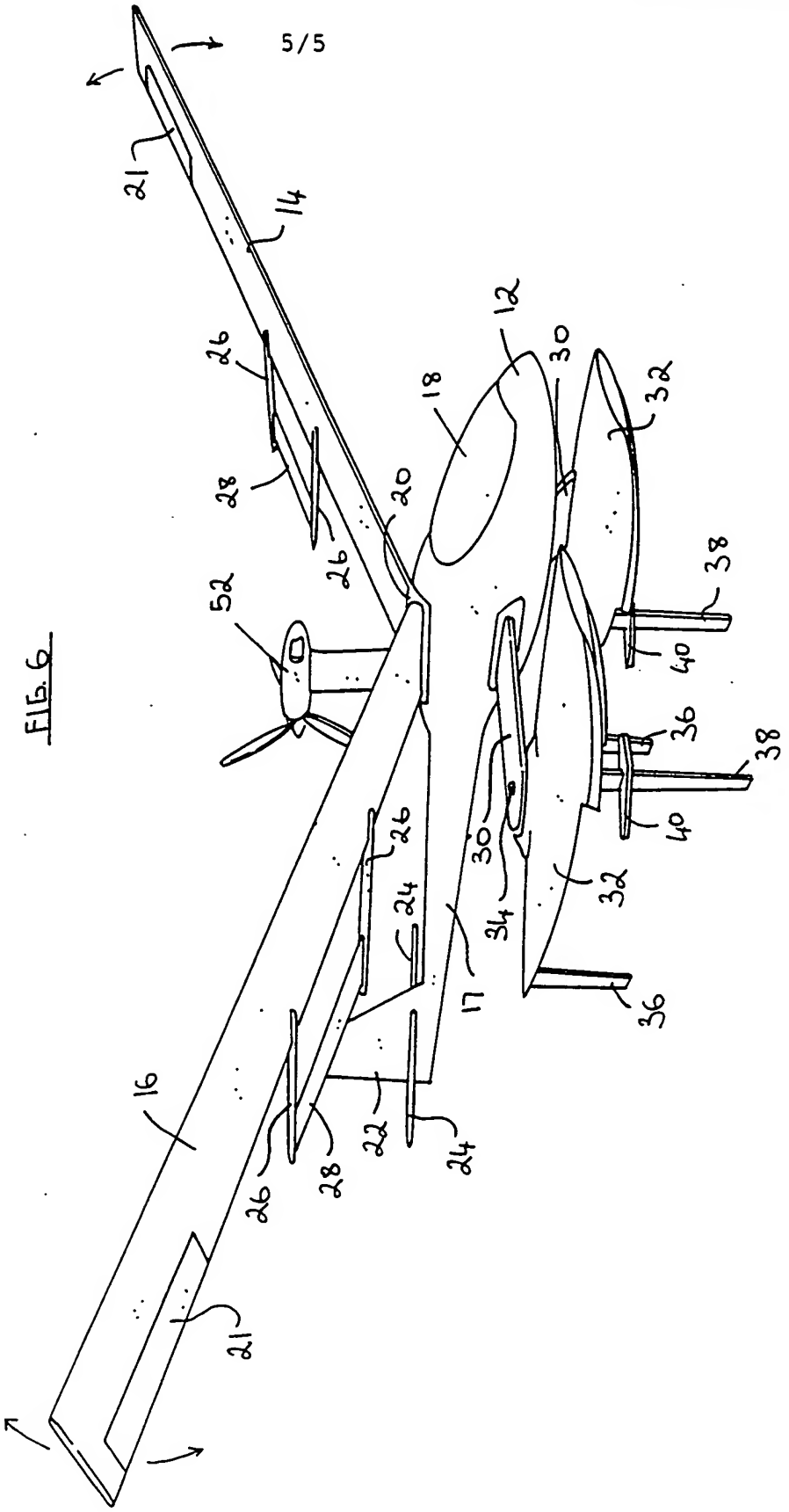

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FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No. PCT/AU 89/00208

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) 6

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[4] B64C 3/38, 31/02, 35/00

II. FIELDS SEARCHED

Minimum Documentation Searched 7

Classification System	Classification Symbols
IPC	B64C 3/38, 31/02, 35/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched 8

AU : IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT 9

Category*	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13
X,Y	US,A,1724755 (FERRUZZI) 13 August 1929 (13.08.29)	1, 2, 5, 9, 14
X	US,A,4357777 (KULIK) 9 November 1982 (09.11.82)	1, 2, 5
Y	US,A,3899146 (AMICK) 12 August 1975 (12.08.75)	6
Y	US,A,3987982 (AMICK) 26 October 1976 (26.10.76)	4, 6
X	US,A,3614024 (MILLMAN) 19 October 1971 (19.10.71)	1
X	US,A,3817478 (MCDONALD) 18 June 1974 (18.06.74)	1
X	US,A,1802285 (MORRIS) 28 April 1931 (28.04.31)	1
X	US,A,1710670 (BONNEY) 23 April 1929 (23.04.29)	1
X	GB,A,1578787 (DOWSON) 12 November 1980 (12.11.80)	1

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
6 July 1989 (06.07.89)	19 July 1989 (19.07.89)
International Searching Authority	Signature of Authorized Officer
Australian Patent Office	P J WHITE

Form PCT/ISA/210 (second sheet) (January 1985)